

What is claimed is:

1. A method for producing a zero-valent transition metal complex (C) by reacting a divalent transition metal complex (A) selected from the group consisting of a divalent ruthenium complex (A¹) and divalent osmium complex (A²) with an olefin (B), wherein the reaction is conducted under reducing conditions and the resulting crude product is treated by hot extraction with a saturated hydrocarbon as an extracting solvent.
2. The method according to Claim 1 for producing a zero-valent transition metal complex, wherein the divalent transition metal complex (A) is selected from the group consisting of a divalent ruthenium-arene complex and divalent osmium-arene complex.
3. The method according to Claim 2 for producing a zero-valent transition metal complex, wherein the arene is a benzene ring substituted with an alkyl of 1 to 20 carbon atoms.
4. The method according to Claim 2 for producing a zero-valent transition metal complex, wherein the divalent ruthenium complex (A¹) is a cymene ruthenium dichloride complex.
5. The method according to Claim 1 for producing a zero-valent transition metal complex, wherein the olefin (B) is a cyclopolyene.
6. The method according to Claim 5 for producing a zero-valent transition metal complex, wherein the cyclopolyene is a cyclodiene.
7. The method according to Claim 1 for producing a zero-valent transition metal complex, wherein the reaction is conducted in an alcohol

solvent in the presence of an elementary metal or metal compound as a reducing agent.

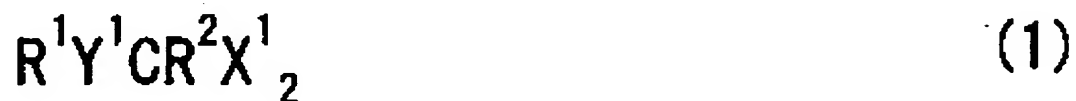
8. The method according to Claim 7 for producing a zero-valent transition metal complex, wherein the metal compound is a sodium compound.

9. The method according to Claim 1 for producing a zero-valent transition metal complex, wherein the hot extraction is conducted at 30°C or higher.

10. The method according to Claim 1 for producing a zero-valent transition metal complex, wherein the saturated hydrocarbon is selected from the group consisting of hexane, heptane and cyclohexane.

11. The method according to Claim 4 for producing a zero-valent transition metal complex, wherein the zero-valent transition metal complex is ruthenium (cymene) (1,5-cyclooctadiene).

12. A method for producing an organometallic compound, wherein the zero-valent transition metal complex (C) produced by one of Claims 1 to 11 is reacted with a compound (D) represented by the general formula (1) and neutral ligand (E) in one step:



(wherein, R^1 is hydrogen atom, or an alkyl group of 1 to 20 carbon atoms, alkenyl group of 2 to 20 carbon atoms or aryl group of 6 to 20 carbon atoms, each group of which may be substituted by an alkyl group of 1 to 5 carbon

atoms, carboxyl group, alkoxy group of 1 to 5 carbon atoms, alkenyloxy group of 1 to 5 carbon atoms, aryloxy group of 6 to 10 carbon atoms, alkylsilyl group of 1 to 6 carbon atoms, arylsilyl group of 6 to 10 carbon atoms, acyl group of 1 to 7 carbon atoms, hydroxyl group, amino group of 0 to 10 carbon atoms, halogen atom, or nitro, acetyl or acetoxy group; Y¹ is a chalcogen atom, nitrogen-containing group represented by the general formula (2) or phosphorus-containing group represented by the general formula (3); and



X¹ is a halogen atom, where R² and R³ in the general formulae are each the same as R¹, and two of R¹ to R³ may be bound to each other).

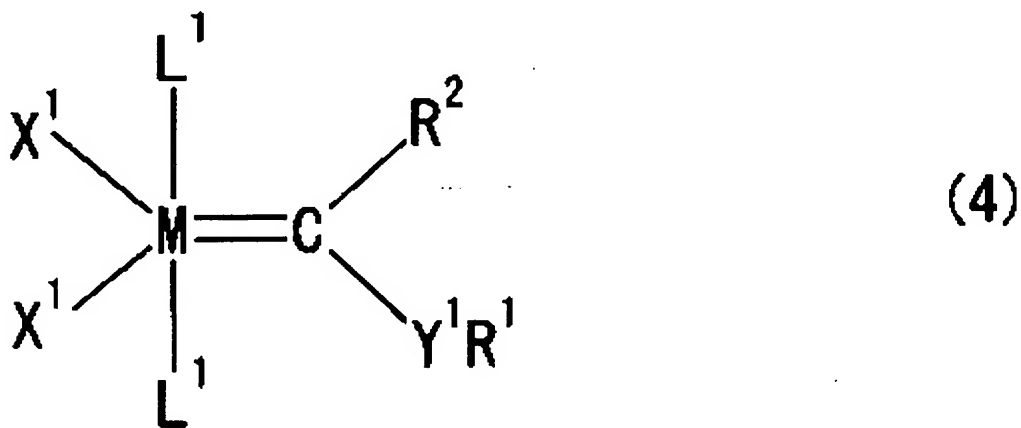
13. The method according to Claim 12 for producing an organometallic compound, wherein R² is hydrogen atom.

14. The method according to Claim 12 for producing an organometallic compound, wherein R¹ or R³ is phenyl group, or phenyl group substituted by at least one substituent selected from the group consisting of an alkyl group of 1 to 5 carbon atoms, carboxyl group, alkoxy group of 1 to 5 carbon atoms, alkenyloxy group of 1 to 5 carbon atoms, aryloxy group of 6 to 10 carbon atoms, alkylsilyl group of 1 to 6 carbon atoms, arylsilyl group of 6 to 10 carbon atoms, acyl group of 1 to 7 carbon atoms, hydroxyl group, amino group of 10 carbon atoms or less, halogen atom, nitro group and acetyl group.

15. The method according to Claim 12 for producing an organometallic compound, wherein Y^1 is selected from the group consisting of oxygen, sulfur and selenium atoms.

16. The method according to Claim 12 for producing an organometallic compound, wherein the neutral ligand (E) is selected from the group consisting of a tertiary phosphine and imidazolium-2-ylidene.

17. The method according to Claim 12 for producing an organometallic compound, wherein the organometallic compound is represented by the general formula (4):



(wherein, M is elementary ruthenium or osmium; R^1 , R^2 , Y^1 and X^1 are each the same as the respective one described before; and L^1 s are each a neutral electron donor, which may be the same or different).

18. The method according to Claim 17 for producing an organometallic compound, wherein R^2 is hydrogen atom.

19. The method according to Claim 17 for producing an organometallic compound, wherein

R¹ or R³ is phenyl group, or phenyl group substituted by at least one substituent selected from the group consisting of an alkyl group of 1 to 5 carbon atoms, carboxyl group, alkoxy group of 1 to 5 carbon atoms, alkenyloxy group of 1 to 5 carbon atoms, aryloxy group of 6 to 10 carbon atoms, alkylsilyl group of 1 to 6 carbon atoms, arylsilyl group of 6 to 10 carbon atoms, acyl group of 1 to 7 carbon atoms, hydroxyl group, amino group of 10 carbon atoms or less, halogen atom, nitro group and acetyl group.

20. The method according to Claim 17 for producing an organometallic compound, wherein Y¹ is selected from the group consisting of oxygen, sulfur and selenium atoms.

21. The method according to Claim 17 for producing an organometallic compound, wherein the organometallic compound is dichloro[bis(tricyclohexylphosphino)phenylthiomethinoruthenium].

22. The method according to Claim 17 for producing an organometallic compound, wherein the organometallic compound is free of an impurity of vinyl hetero compound or vinyl compound.